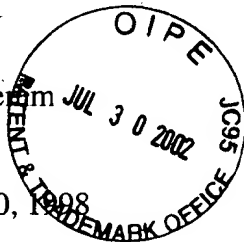*AF/2700*

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION

Applicant(s): Reinhard Klemm
Case: 2
Serial No.: 09/164,509
Filing Date: September 30, 1998
Group: 2152
Examiner: S. Willett

RECEIVED
AUG 0 8 2002
Technology Center 2100

Title: Method and Apparatus for Prefetching Internet Resources Based
             on Estimated Round Trip Time

TRANSMITTAL OF APPEAL BRIEF

Assistant Commissioner of Patents
Washington, D.C. 20231

Sir:

Submitted herewith are the following documents relating to the above-identified

patent application:

(1) Appeal Brief (original and two copies); and

(2) Copy of Notice of Appeal, filed on May 30, 2001, with copy of stamped

return postcard indicating receipt of Notice by PTO on June 4, 2001.

There is an additional fee of $320 due in conjunction with this submission under 37

CFR § 1.17(c). Please charge **Deposit Account No. 50-0762** the amount of $320, to cover this fee.

In the event of non-payment or improper payment of a required fee, the Commissioner is authorized

to charge or to credit **Deposit Account No. 50-0762** as required to correct the error. A duplicate

copy of this letter and two copies of the Appeal Brief are enclosed.

Respectfully,

Kevin M. Mason

Date: July 24, 2002

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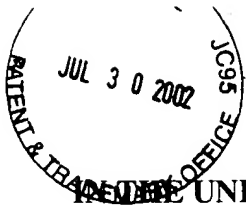
Klemm 2

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPEAL BRIEF

Assistant Commissioner for Patents
20 Washington, D.C. 20231

BOX AF

Sir:
25

        Applicant hereby appeals the final rejection dated April 2, 2002, of claims 1 through 29 of the above-identified patent application.

REAL PARTY IN INTEREST

30   The present application is assigned to Lucent Technologies Inc., as evidenced by an assignment recorded on September 30, 1998 in the United States Patent and Trademark Office at Reel 9491, Frame 0209. The assignee, Lucent Technologies Inc., is the real party in interest.

35   ## STATUS OF CLAIMS

        Claims 1 through 29 are pending in the above-identified patent application. Claims 1, 4-8, 14-16, 20-22, 25-29 remain rejected under 35 U.S.C. §103(a) as being unpatentable over Kunkel et al. (United States Patent Number 5,961,603) in view of Narayanaswami (United States Patent Number 6,182,113). In addition, claims 1
40 through 29 remain rejected under 35 U.S.C. §103(a) as being unpatentable over Kunkel et

al. (United States Patent Number 5,961,603) in view of Vaid et al. (United States Patent Number 6,119,235).

STATUS OF AMENDMENTS

There have been no amendments filed subsequent to the final rejection.

SUMMARY OF INVENTION

The present invention is directed to methods and apparatus for prefetching Internet resources based on the estimated round trip time for the resources referenced in a currently displayed Web page. Documents with the longest access times are prefetched first and prefetching generally continues until the estimated round trip time falls below a predefined threshold. Thus, if a user clicks on an embedded hyperlink, the referenced document has either been fetched already or, if not, fetching the document from the origin server takes only a short time.

The "round trip" time or access time of a resource is the time interval between the sending of the first byte of an HTTP request for the resource until the last byte of the server response has arrived at the requesting Web client. The round trip time may be estimated in accordance with the present invention, for example, using an HTTP HEAD request. A HEAD request obtains status information and the size of the requested resource, s, from the origin server. If the server responds to the HEAD request with the document size, s, the prefetching agent computes the estimated round trip time for further processing. If the server responds but fails to specify the document size, the prefetching agent utilizes the recorded average resource size, s, of resources previously received from the server. If the HEAD request does not yield any response from the server, or if the response shows an error code, then the prefetching agent determines that the hyperlinked document is not accessible and can provide an error message immediately once the user clicks on this hyperlink.

ISSUES PRESENTED FOR REVIEW

i. Whether Claims 1, 4-8, 14-16, 20-22, 25-29 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over Kunkel et al.

(United States Patent Number 5,961,603) in view of Narayanaswami (United States Patent Number 6,182,113); and

ii.   Whether Claims 1 through 29 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over Kunkel et al. (United States Patent Number 5,961,603) in view of Vaid et al. (United States Patent Number 6,119,235).

GROUPING OF CLAIMS

The rejected claims do not stand and fall together. More particularly, for the reasons given below, Applicant believes that each of the dependent claims 3-6, 11-16, 19-22 and 23-24 provide independent bases for patentability apart from the rejected independent claims.

ARGUMENT

Claims 1, 4-8, 14-16, 20-22, 25-29 are rejected under 35 U.S.C. §103(a) as being unpatentable over Kunkel et al. in view of Narayanaswami. In the final rejection, the Examiner asserts that Kunkel et al. discloses the prefetching of Internet resources (citing col. 5, lines 1-5). The Examiner further asserts that Kunkel et al. teaches fetching data "dependent on round trip times based on send and receive times and data size as 'by keeping statistics corresponding to the number of corrupted data packets received on each of the upstream channels' (citing col. 8, lines 14-16) and 'if a hyperlink request acknowledge (ACK) is subsequently received with a pre-determined number of time periods.'" (citing col. 11, lines 61-63).

The passage referenced by the Examiner at col. 8, lines 14-16 is directed to the detection of a channel having a noise level that exceeds a threshold. The number of received corrupted data packets has *nothing* to do with "round trip times" in the context of the present invention. Similarly, the passage referenced by the Examiner at col. 11, lines 61-63 is directed to determining when an affirmative hyperlink request has been successfully received. The receipt of an acknowledgement (ACK) within a pre-determined number of time periods has *nothing* to do with "round trip times" in the context of the present invention.

In any event, the Examiner subsequently acknowledges that Kunkel et al. do not disclose or suggest the prefetching of data based on round trip times and data size.

The Examiner further asserts that Narayanaswami teaches that present Web pages are resolved periodically so as to maintain a list of currently active links based on one or more variables. (citing col. 6, lines 17-22). The Examiner also notes that Narayanaswami teaches the use of user-specified criteria, such as (time of day) TOD, (citing col. 7, lines 10-13) and that savings will result from implementing the downloading system. The disclosed user-specified criteria are limited to *time of day*, as well as location of the data or bandwidth availability.

Interestingly, the Examiner does not assert that Narayanaswami suggests the prefetching of data based on round trip times. None of the user-specified criteria correlate with a round trip time.

Thus, Kunkel or Narayanaswami, alone or in combination, do not disclose or suggest prefetching one or more Internet resources based on an estimated round trip time that is "based on an interval of time between a sending of an HTTP request and a receipt of a response to said HTTP request," as required by each of the independent claims, as amended.

In addition, claims 1 through 29 are rejected under 35 U.S.C. §103(a) as being unpatentable over Kunkel et al. in view of Vaid et al. As previously indicated, the Examiner has acknowledged that Kunkel et al. do not disclose or suggest the prefetching of data based on round trip times and data size.

The Examiner asserts that Vaid teaches a system to schedule downloading of data in order to provide optimized computer usage. In addition, the Examiner notes that Vaid teaches "estimating a bit rate over a round-trip time between the data source and the data receiver." *citing* Abstract.

While Vaid may disclose the estimation of round-trip times of data exchanged between a sender and a receiver in a data network, Vaid estimates the round-trip times of *TCP/IP packets*. The present invention, on the other hand, estimates the round-trip times of *HTTP request/response events*, as required by each of the independent claims. *The distinction between round-trip times of TCP/IP packets and HTTP*

request/response events was argued by Applicant in a prior response, but was not addressed by the Examiner in the final Office Action.

As indicated in Applicant's prior response, HTTP traffic travels through software that runs atop TCP/IP stacks on client, server, and proxy computers. HTTP

5   traffic therefore incurs latencies caused by such software. These latencies are generally not reflected in the TCP/IP round-trip times computed by Vaid. Moreover, HTTP traffic for the purpose of Web document prefetching, as in the context of the present invention, shows characteristics in terms of length and origin server access frequency that general TCP/IP traffic does not exhibit (the origin server is referred to as the "receiver" in Vaid).

10   The present invention takes advantage of such HTTP traffic characteristics in its round-trip time estimation.

The present invention considers the length of an HTTP response (e.g., via an HTTP HEAD request) and the actually measured round-trip times of previous HTTP requests to the same origin server when computing the estimated round-trip time of an

15   HTTP request/response event. Thus, the round-trip time estimations of the present invention are dynamically adjusted, based on changing network and server conditions, because estimates are based on previously measured round-trip times of HTTP request/response events to the same origin server. The adaptation to changing actual round-trip times is effected by a linear weighing function that uses previous HTTP

20   request/response events, if available, to the same origin server as data points. If there was no previous HTTP request/response event to the same origin server in the past, a baseline estimate is established through actually fetching a document from the origin server via an HTTP GET request rather than estimating the round-trip time of the document. Vaid uses an unspecified baseline estimate in all cases.

25   Thus, Kunkel or Vaid, alone or in combination, do not disclose or suggest prefetching one or more Internet resources based on an estimated round trip time that is "based on an interval of time between a sending of an *HTTP* request and a receipt of a response to said *HTTP* request," as required by each of the independent claims.

The following example helps to illustrate the distinction between round-

30   trip times of TCP/IP packets and HTTP request/response events and the fundamental differences between Vaid and the present invention, but it is the presently pending claims

-5-

that define the scope of the invention. Assume that a user, A, is communicating with two servers, B and C. The time interval between A sending a TCP packet to B and receiving back an acknowledgement is 100 msec. The time interval between A sending a TCP packet to C and receiving back an acknowledgement is 200 msec. Further assume that

5   identical Web servers are added to both B and C and that B has a slower processor than C. An HTTP request for a resource, R, processed by the Web server on machine B takes 400 msec, whereas processing an HTTP request for a resource, R', by the Web server on C takes 100 ms. It is assumed that the HTTP requests for R and R' and the HTTP responses to R and R' all fit in one TCP/IP packet each, a quite typical scenario.

10   Thus, the estimated round trip time for sending the HTTP request for resource, R, from machine A to B (100 msec), processing the request in B's HTTP server (400 msec), and sending the HTTP response back to A (100 msec) is a total of 600 msec. The estimated round trip time for sending the HTTP request for resource, R', from machine A to C (200 msec), having C's HTTP server process the request (100 msec) and

15   sending the response back to A (200 msec) is a total of 500 msec.

                Thus, based on the TCP round trip time computed by Vaid, the resource from server C (with the longer TCP time) would be prefetched first. Based on the estimated round trip time computed by the present invention, however, the resource from server B (with the longer estimated HTTP round trip time) would be prefetched first.

20   Thus, applying the present invention to this example yields exactly the opposite result that would be achieved using the round trip time of Vaid. However, Applicant asserts that this inventive method results in a more responsive and enjoyable user experience with reduced latencies in obtaining requested Web resources.

                In addressing Applicant's prior Remarks, the Examiner notes on page 5,

25   paragraph 13 that "round trip time is widely known, as implied in the HEAD function." The HEAD function, however, was not used to estimate round trip time prior to the present invention. Rather, the HEAD function, as intended, is merely used to collect status information. It was the present invention that suggested that in an exemplary embodiment, the HEAD function can be used to estimate the round trip time.

The rejections of the independent claims under section §103 in view of Kunkel, Narayanaswami or Vaid, alone or in any combination, are therefore believed to be improper and should be withdrawn.

Dependent Claims

5   With regard to a number of dependent claims, identified above as being separately patentable, these claims specify a number of limitations providing additional bases for patentability. Specifically, as already established, Kunkel, Narayanaswami or Vaid, alone or in combination, do not disclose or suggest the estimation round trip time using HTTP request/response events. Dependent claims 3-6 and 19-22 provide additional

10   limitations on how the round trip time is estimated in various embodiments of the present invention. These additional limitations are not disclosed by the prior art of record. Other than claim 3, the Examiner did not specifically address these claims in the final rejection. With regard to claim 3, the Examiner indicates that Kunkel teaches prefetching based on previous accesses. Kunkel, however, does not indicate how such previous accesses

15   impact the estimation of round trip time, as set for in dependent claims 3-6 and 19-22.

With regard to claims 11-16 and 23-24, which are directed to filtering the set of resources that are prefetched to reduce the overhead on the network, the Examiner suggests that Kunkel teaches the filtering of data at col. 5, 7, 8, lines 65-67, 59-63 and 6-10, respectively. The only reference Applicant can find to a filter or the filtering of data

20   in Kunkel is a diplex filter 86 that "separates upstream channel hyperlink information requests received from the users over the transmission link 18, from the downstream television signals." See, col. 7, lines 59-63. This diplex filter 86 does not reduce the number of resources that are prefetched to reduce the overhead on the network, as required by claims 11-16 and 23-24 of the present invention.

25   The remaining rejected dependent claims are believed allowable for at least the reasons identified above with respect to the independent claims.

The attention of the Examiner and the Appeal Board to this matter is appreciated.

5

Respectfully,

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Date: July 24, 2002

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10

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APPENDIX

1

2   1.   A method of prefetching one or more Internet resources referenced in one or more

3   Web pages, said method comprising the steps of:

4   obtaining an estimated round trip time for said Internet resources, wherein said

5   estimated round trip time is based on an interval of time between a sending of an HTTP request

6   and a receipt of a response to said HTTP request; and

7   prefetching said Internet resources based on said estimated round trip time.

1   2.   The method according to claim 1, wherein two or more of said Internet resources

2   are prefetched substantially in parallel.

1   3.   The method according to claim 1, wherein said step of prefetching said Internet

2   resources based on said estimated round trip time is performed only for Internet resources

3   associated with origin servers that have been previously accessed and said method further

4   comprising the step of prefetching all Internet resources associated with servers that have not

5   been previously accessed.

1   4.   The method according to claim 1, wherein said estimated round trip time for each

2   Internet resource is based on average access time statistics for the corresponding origin server

3   and the actual size of said Internet resource when said actual size is available.

1   5.   The method according to claim 4, wherein said estimated round trip time for each

2   Internet resource is based on average access time statistics for the corresponding origin server

3   and the average size of Internet resources provided by said origin server if said origin server does

4   not indicate said actual size.

1   6.   The method according to claim 4, wherein said estimated round trip time for each

2   Internet resource is based on average access time statistics for the corresponding origin server

3   and the average size of Internet resources provided by said origin server if the setup and wait

4   time for accessing said origin server is not significantly less than the average round trip time for

5   Internet resources obtained from said origin server.

1   7.   The method according to claim 1, wherein said estimated round trip time is based

2   on at least one actual prior round trip time for said Internet resource.

1   8.   The method according to claim 1, wherein said step of prefetching said Internet

2   resources does not begin until said one or more Web pages have been fetched.

1   9.   The method according to claim 1, wherein said step of prefetching said Internet

2   resources continues until said Internet resources have been prefetched or until a user selects a

3   new Web page.

1   10.   The method according to claim 1, further comprising the steps of storing said

2   Internet resources in a cache and determining if any of said Internet resources are already stored

3   in said cache before prefetching begins.

1   11.   The method according to claim 1, further comprising the step of applying a filter

2   to said Internet resources to reduce the overhead on network, server or local resources due to

3   prefetching.

1   12.   The method according to claim 11, wherein said filter discards all Internet

2   resources that do not use the HTTP protocol for transmission.

1   13.   The method according to claim 11, wherein said filter discards all Internet

2   resources that corresponding to dynamically generated Web resources.

1   14.   The method according to claim 11, wherein said filter discards all Internet

2   resources that correspond to resources whose size is more than a certain maximum size

3   threshold.

1   15.   The method according to claim 11, wherein said filter discards all Internet

2   resources that correspond to resources whose estimated round trip time is longer than a certain

3   maximum time.

1   16.   The method according to claim 11, wherein said filter discards all Internet

2   resources that correspond to resources whose estimated round trip time is shorter than a certain

3   minimum time threshold.

1   17.   A method of prefetching one or more Internet resources referenced in one or more

2   Web pages, said method comprising the steps of:

3   determining an estimated round trip time for said Internet resources based on an

4   interval of time between a sending of an HTTP request and a receipt of a response to said HTTP

5   request;

6   sorting a list of said Internet resources based on said estimated round trip time;

7   prefetching said sorted list of Internet resources until one or more predefined

8   threshold conditions are met.

1   18.   The method according to claim 17, wherein two or more of said Internet resources

2   are prefetched substantially in parallel.

1   19.   The method according to claim 17, wherein said step of prefetching said Internet

2   resources based on said estimated round trip time is performed only for resources associated with

3   origin servers that have been previously accessed and said method further comprising the step of

4   prefetching all resources associated with servers that have not been previously accessed.

1   20.   The method according to claim 17, wherein said estimated round trip time for

2   each Internet resource is based on average access time statistics for the corresponding origin

3   server and the actual size of said Internet resource when said actual size is available.

1   21.   The method according to claim 20, wherein said estimated round trip time for

2   each Internet resource is based on average access time statistics for the corresponding origin

3   server and the average size of Internet resources provided by said origin server if said origin

4   server does not indicate said actual size.

1   22.   The method according to claim 20, wherein said estimated round trip time for

2   each Internet resource is based on average access time statistics for the corresponding origin

3   server and the average size of Internet resources provided by said origin server if the setup and

4   wait time for accessing said origin server is not significantly less than the average round trip time

5   for Internet resources obtained from said origin server.

1   23.   The method according to claim 20, further comprising the step of applying a filter

2   to said Interent resources to reduce the overhead on network, server or local resources due to

3   prefetching.

1   24.   The method according to claim 23, wherein said filter discards all Internet

2   resources selected from the set comprised substantially of those Internet resources that (i) do not

3   use the HTTP protocol for transmission; (ii) correspond to dynamically generated Web

4   resources; (iii) correspond to resources whose size is more than a certain maximum size

5   threshold, (iv) correspond to resources whose estimated round trip time is longer than a certain

6   maximum time, or (v) correspond to resources whose estimated round trip time is shorter than a

7   certain minimum time threshold.

1   25.   A system for prefetching one or more Internet resources referenced in one or

2   more Web pages, each of said Internet resources having an associated origin server, said tool

3   comprising:

4   a memory for storing a server statistics database that records access time statistics

5   for each origin server that has been previously accessed;

6   a processor operatively coupled to said memory, said processor configured to:

7   obtain an estimated round trip time for said Internet resources, wherein said

8   estimated round trip time is based on an interval of time between a sending of an HTTP request

9   and a receipt of a response to said HTTP request; and

10   prefetch said Internet resources based on said estimated round trip time.

1

2   26.   The system according to claim 25, wherein said server statistics database records

3 the average setup, wait and byte transmission times and average resource size for said Internet

4 resources obtained from said corresponding origin server.

1   27.   A method of prefetching one or more Internet resources referenced in one or more

2 Web pages, said method comprising the steps of:

3   determining if one or more of said Internet resources are candidates for

4 prefetching based on an estimated round trip time, wherein said estimated round trip time is

5 based on an interval of time between a sending of an HTTP request and a receipt of a response to

6 said HTTP request; and

7   prefetching said Internet resources that are determined to be candidates for

8 prefetching.

1   28.   An article of manufacture for prefetching one or more Internet resources

2 referenced in one or more Web pages, said article of manufacture comprising:

3   a computer readable medium having computer readable program code means

4 embodied thereon, said computer readable program code means comprising program code means

5 for causing a computer to:

6   obtain an estimated round trip time for said Internet resources, wherein said

7 estimated round trip time is based on an interval of time between a sending of an HTTP request

8 and a receipt of a response to said HTTP request; and

9   prefetch said Internet resources based on said estimated round trip time.

1   29.   A method of prefetching one or more Internet resources referenced in one or more

2 Web pages, said method comprising the steps of:

3   obtaining an estimated round trip time for said Internet resources, wherein said

4 estimated round trip time is based on an interval of time between a sending of an HTTP request

5 and a receipt of a response to said HTTP request;

6   identifying a subset of said Internet resources that are candidates for prefetching

7 based on said estimated round trip time; and

-13-

8   determining whether to prefetch one or more of said Internet resources in said

9   subset of Internet resources based on predefined conditions, at least one of said predefined

10   conditions being based on said estimated round trip time.